CORSIA - Environmental effects and competitive implications

(Original title: Environmental effects and financial impacts on the aviation sector)

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Picture: Sven Maertens

1. Background / Research questions

- **Air transport emissions** (CO_2 and non-CO_2) contribute to man-made **climate change** - **Total climate impact about 4.9% in 2005** (Lee et al., 2009)
- **Growing air transport** market as challenge, action needed (at least re. CO_2).
- From 2021, a **large percentage** of the **carbon emission growth** in **international aviation** will be **subject to CORSIA** (Carbon Offsetting and Reduction Scheme for International Aviation).
- The **future of the** existing **EU ETS** (EU emissions trading scheme) for aviation is **still unclear**.

What are the expected environmental and competitive effects of CORSIA?

Overview

1. **Background & Research questions**
2. **CORSIA: Genesis and key provisions**
   - Genesis of the EU ETS and CORSIA
   - CORSIA at a glance
   - CORSIA vs EU ETS: Main similarities and differences
3. **Environmental impact of CORSIA**
   - Methodology and data for emission calculation
   - Results
4. **Competitive impacts at the airline level**
5. **Summary and Conclusion**

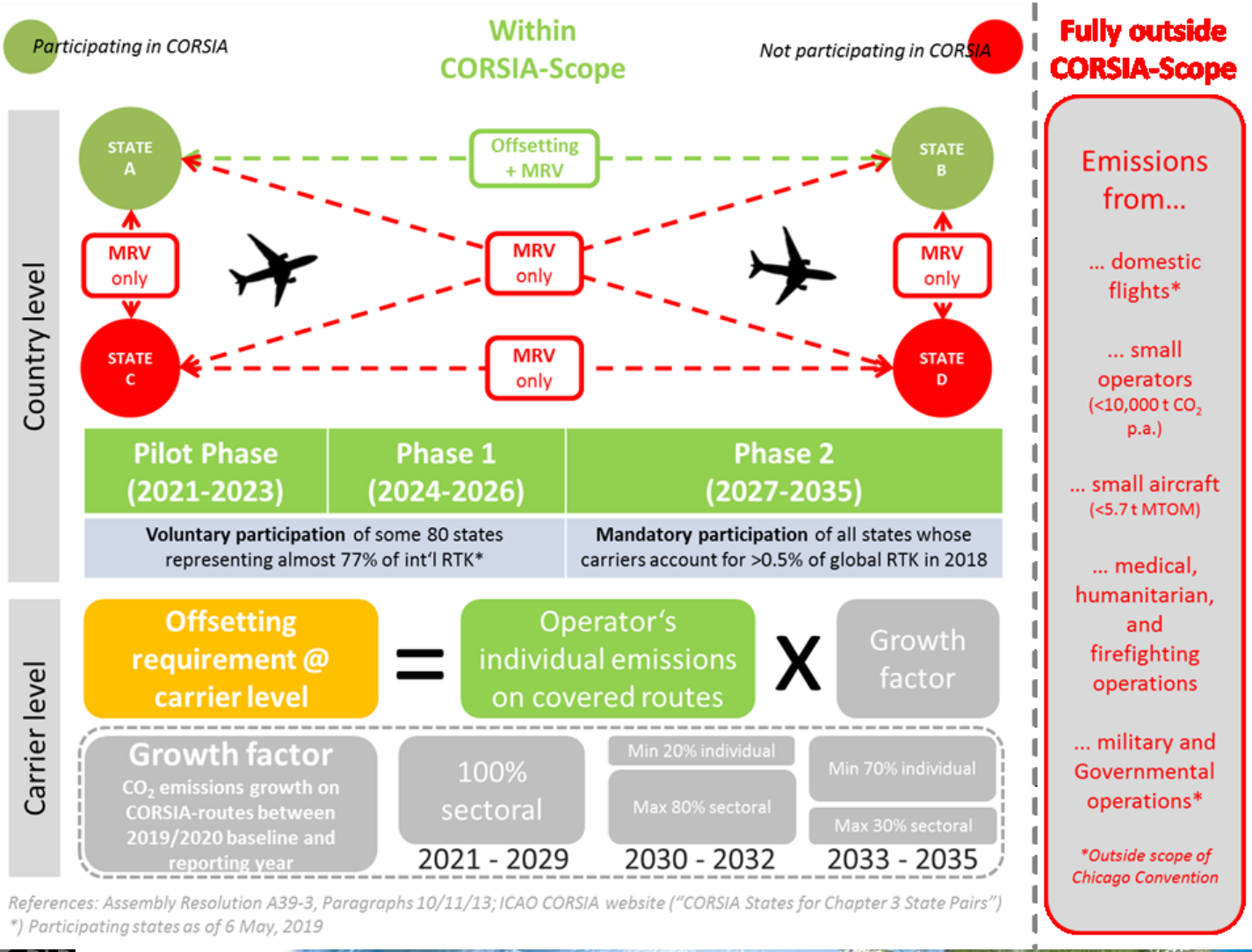
2. CORSIA: Genesis and key provisions

Genesis of the measures

Year	World	EU
1997	**Kyoto Protocol (Art 2): ICAO tasked to prepare policy measures** to reduce **aviation GHG** emissions	
1997-2016	**Long-lasting political process**	
		2012: EU ETS for aviation (2008/101/EC, 2009/29/ EC)
2016	Assembly Resolution A39-3 on **CORSIA**	
2021	Inauguration of **CORSIA offsetting**	**Potential conflicts** (Overlapping scope…)

2. CORSIA: Genesis and key provisions

Key provisions of CORSIA



References: Assembly Resolution A39-3, Paragraphs 10/11/13; ICAO CORSIA website ("CORSIA States for Chapter 3 State Pairs")
**) Participating states as of 6 May, 2019*

2. CORSIA: Genesis and key provisions

CORSIA: Participating countries (as of 8 May, 2019)

1. Albania
2. Armenia
3. Australia
4. Austria
5. Azerbaijan
6. Belgium
7. Bosnia and Herzegovina
8. Botswana
9. Bulgaria
10. Burkina Faso
11. Cameroon
12. Canada
13. Costa Rica
14. Croatia
15. Cyprus
16. Czech Republic
17. Democratic Republic of Congo
18. Denmark
19. Dominican Republic
20. El Salvador
21. Equatorial Guinea
22. Estonia
23. Finland
24. France
25. Gabon
26. Georgia
27. Germany
28. Ghana
29. Greece
30. Guatemala
31. Guyana
32. Hungary
33. Iceland
34. Indonesia
35. Ireland
36. Israel
37. Italy
38. Jamaica
39. Japan
40. Kenya
41. Latvia
42. Lithuania
43. Luxembourg
44. Malaysia
45. Malta
46. Marshall Islands
47. Mexico
48. Monaco
49. Montenegro
50. Namibia
51. Netherlands
52. New Zealand
53. Nigeria
54. North Macedonia
55. Norway
56. Papua New Guinea
57. Philippines
58. Poland
59. Portugal
60. Qatar
61. Republic of Korea
62. Republic of Moldova
63. Romania
64. San Marino
65. Saudi Arabia
66. Serbia
67. Singapore
68. Slovakia
69. Slovenia
70. Spain
71. Sweden
72. Switzerland
73. Thailand
74. Turkey
75. Uganda
76. Ukraine
77. United Arab Emirates
78. United Kingdom
79. United States
80. Zambia

Emissions from routes between these countries subject to CORSIA offsetting.

Key markets like BRIC supposed to join from 2027 only (mandatory phase).

2. CORSIA: Genesis and key provisions

Main similarities and differences (Overview)

Scheme		EU ETS	CORSIA
Fundamental similarities and differences	Aim	Reaching a fixed envirnmental goal efficiently	
	Methodology	Cap&Trade	Offsetting
	Environmental integrity	Not critical because overall cap is fixed	Depending on quality standards of the offsets
	Need for verification	Only at emitter level	Emitter and offsetting project level
Similarities and differences in implemen-tation and application	Cap/Baseline	95% of avg. 2004/2006 emissions; stepwise further reduction of cap envisaged	Avg 2019/2020 emissions; no further reduction envisaged
	Scope	Intra-EEA including domestic flights (route-level approach)	Int'l routes between participating states (route-level approach)
	Affected carriers	All airlines operating on affected routes (few exceptions)	

Cames et al. (2016): "73% of the … Certified Emissions Reduction (CER) supply have a low likelihood" and only "7% … have a high likelihood of ensuring that emission reductions are additional and … not over-estimated"

3. Environmental impact of CORSIA

Methodology and data for emission calculation

Estimation of route-level CO_2 emissions using 4D RACE tool for global passenger flight plan 2016 (Innovata) (*)

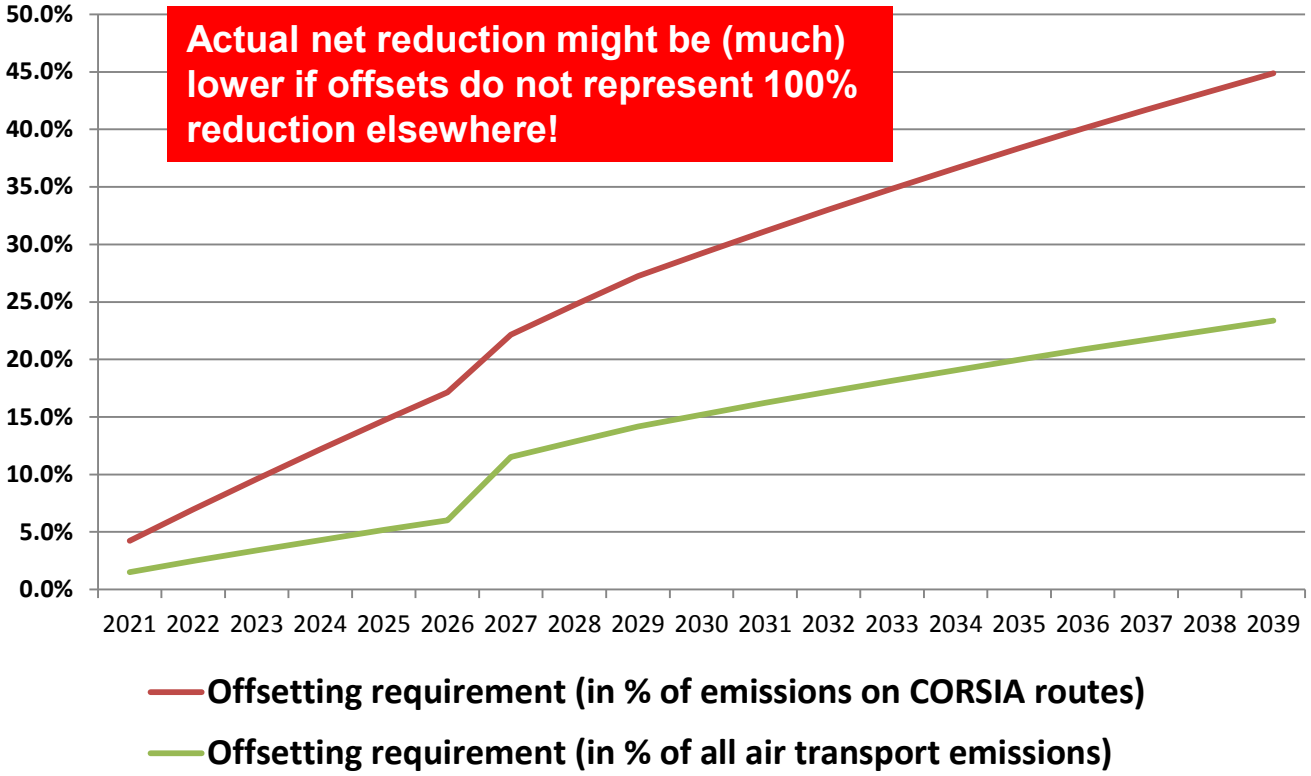
Forecast of future flights & CO_2 emissions until 2039 for FESG 'Central' scenario, assuming an average autonomous fuel efficiency increase of 1.2% p. a. (*)

Aggregation of route-level CO_2 estimates

Identification of CORSIA-routes & Application of the CORSIA baseline to calculate the emission net reduction

**) See Scheelhaase et al. (2012), Cost impacts of the inclusion of air transport into the European Emissions Trading Scheme in the period 2012-2020, Eur. J. Transp. Infrastruct. Res. 12 (4), 332-348.*

3. Environmental impact of CORSIA



In 2021, the airline sector has to offset some 4% of emissions from CORSIA-routes. This share increases to 22% in 2027.
This represents potential offsetting of total air transport emissions (incl. domestic and other non-CORSIA) of just 1.5% in 2021 and 11.5% in 2027.

3. Environmental impact of CORSIA

Year	Offsetting effects of CORSIA (2021-2026 voluntary; from 2027 mandatory+voluntary)					
	Emissions in Mt *(subject to CORSIA offsetting)*	Annual Growth in %	Mt Growth over avg 2019/2020 baseline *(adjusted from 2027)*	Share of worldwide air transport emissions covered by CORSIA	sectoral Offsetting requirement *(=growth since baseline divided by total CORSIA emissions)*	CORSIA Reduction share as percentage of total global emissions
2016	268.2	0%	0	37%	0.0%	0.0%
2017	278.0	4%	0	36%	0.0%	0.0%
2018	288.3	4%	0	36%	0.0%	0.0%
2019	298.9	4%	0	36%	0.0%	0.0%
2020	307.6	3%	0	36%	0.0%	0.0%
2021	316.6	3%	13.4	36%	4.2%	1.5%
2022	325.9	3%	22.6	36%	6.9%	2.5%
2023	335.5	3%	32.2	35%	9.6%	3.4%
2024	345.3	3%	42.1	35%	12.2%	4.3%
2025	355.5	3%	52.2	35%	14.7%	5.2%
2026	366.0	3%	62.7	35%	17.1%	6.0%
2027	561.9	54%	124.5	52%	22.2%	11.5%
...	581.2	3%	143.8	52%	24.7%	12.9%
2039	793.3	3%	355.9	52%	44.9%	23.4%

4. Competitive impacts at the airline level

The relative (financial) impact of CORSIA at the particular airline level will mainly depend on the geographical route:

- Share of emissions from domestic routes
- Share of emissions from other non-CORSIA routes
- Until 2029, each airline has to apply the sectoral emission growth rate to its own emission volumes to calculate its offsetting requirement:

  Multiplication of an operator's total CO2 emissions covered by CORSIA by the "sector's growth factor".
- Own, specific emission growth will matter from 2030 only

4. Competitive impacts at the airline level

Assessment of the individual CORSIA impact on selected airlines

- Use of the share of revenues from routes subject to CORSIA as proxy.
- Methodology:
    A. Data inputs: airline revenues by region-pair, 2018, from Sabre MI leg statistics
    B. Estimation of future revenues (2021/2027) in applying FESG traffic growth rates at region pair level to the 2018 revenues
    C. Calculation of 2021/2027 revenues shares subject to CORSIA
- Assumptions: All airline revenues develop according to region-pair-specific growth rates; no individual environmental efficiency gains; Correlation of revenues and CO_2

4. Competitive impacts at the airline level

Results (2021)

Airline	Category	Revenues 2021 (USD)		
		Total	CORSIA-routes	Share
Emirates	BoGu	31,292,328,246	21,464,446,193	69%
Turkish Airlines Inc.	BoGu	16,170,559,180	7,839,577,971	48%
Qatar Airways (Q.C.S.C.)	BoGU	12,484,423,612	8,754,567,713	70%
PJSC Aeroflot	BRIC	10,404,715,504	5,079,766	0%
Air China Limited	BRIC	20,277,502,225	22,900,118	0%
China Southern Airlines	BRIC	23,120,020,978	16,980,610	0%
China Eastern Airlines	BRIC	21,782,285,069	14,650,146	0%
Ryanair Ltd.	EU LCC	21,518,161,522	18,529,328,978	86%
Easyjet Airline Company Limited	EU LCC	13,987,357,634	11,241,906,121	80%
Deutsche Lufthansa AG	EU Network	25,626,275,246	17,527,147,977	68%
Virgin Atlantic Airways Limited	EU Network	4,419,749,650	3,123,682,266	71%
Air France	EU Network	21,923,524,948	11,907,728,123	54%
KLM Royal Dutch Airlines	EU Network	13,191,469,962	9,197,277,453	70%
British Airways p.l.c.	EU Network	30,633,300,185	21,616,290,367	71%
Southwest Airlines Co	US LCC	23,016,603,873	828,490,694	4%
United Airlines, Inc.	US Network	49,352,838,851	16,410,683,217	33%
American Airlines	US Network	42,095,076,925	8,533,276,387	20%
Delta Air Lines, Inc.	US Network	53,599,708,717	16,096,811,901	30%

4. Competitive impacts at the airline level

Results (2027)

Airline	Category	Revenues 2027 (USD)		
		Total	CORSIA-routes	Share
Emirates	BoGu	42,309,879,409	42,240,880,146	100%
Turkish Airlines Inc.	BoGu	20,597,087,777	16,245,741,208	79%
Qatar Airways (Q.C.S.C.)	BoGU	16,828,658,105	16,787,815,764	100%
PJSC Aeroflot	BRIC	13,193,938,499	8,784,500,846	67%
Air China Limited	BRIC	28,442,314,977	10,661,834,530	37%
China Southern Airlines	BRIC	32,400,283,174	7,824,624,454	24%
China Eastern Airlines	BRIC	30,501,249,217	7,898,092,023	26%
Ryanair Ltd.	EU LCC	27,104,489,649	24,331,858,673	90%
Easyjet Airline Company Limited	EU LCC	17,566,122,735	14,594,997,221	83%
Deutsche Lufthansa AG	EU Network	32,913,589,120	30,043,898,042	91%
Virgin Atlantic Airways Limited	EU Network	5,641,838,238	5,573,319,941	99%
Air France	EU Network	28,133,911,086	24,956,903,913	89%
KLM Royal Dutch Airlines	EU Network	16,988,257,258	16,823,899,591	99%
British Airways p.l.c.	EU Network	39,278,828,177	37,663,943,913	96%
Southwest Airlines Co	US LCC	26,307,323,323	1,189,184,676	5%
United Airlines, Inc.	US Network	59,805,787,213	29,213,507,297	49%
American Airlines	US Network	49,858,947,246	16,562,870,610	33%
Delta Air Lines, Inc.	US Network	64,152,292,317	25,965,317,607	40%

5. Summary and Conclusion

- In 2021, the airline sector has to offset some 4% of emissions from CORSIA-routes. This share increases to 22% in 2027.
- Even if offsets really represented 100% emission reduction elsewhere, these rates would just represent net reductions of total air transport emissions (incl. domestic and other non-CORSIA) of 1.5% in 2021 and 11.5% in 2027.
- Airlines with a high share of international routes to participating states are more impacted by CORSIA than others. This mainly applies to European (low cost carriers) and Gulf carriers.
- BRIC-Carriers will only be affected from 2027 when participation becomes mandatory. As with US carriers, they are less impacted than their European/Gulf counterparts as domestic routes are excluded from CORSIA.
- More sophisticated assessment of the scheme's financial impact would require CO_2 modelling at the airline level and expected priced for CORSIA emission units.

Thank you!